Human Factors Assessment and Redesign of the ISS Respiratory Support Pack (RSP) Cue Card

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The Respiratory Support Pack (RSP) is a medical pack onboard the International Space Station (ISS) that contains much of the necessary equipment for providing aid to a conscious or unconscious crewmember in respiratory distress. Inside the RSP lid pocket is a 5.5 by 11 inch paper procedural cue card, which is used by a Crew Medical Officer (CMO) to set up the equipment and deliver oxygen to a crewmember. In training, crewmembers expressed concerns about the readability and usability of the cue card; consequently, updating the cue card was prioritized as an activity to be completed. The Usability Testing and Analysis Facility at the Johnson Space Center (JSC) evaluated the original layout of the cue card, and proposed several new cue card designs based on human factors principles.

The approach taken for the assessment was an iterative process. First, in order to completely understand the issues with the RSP cue card, crewmember post training comments regarding the RSP cue card were taken into consideration. Over the course of the iterative process, the procedural information was reorganized into a linear flow after the removal of irrelevant (non-emergency) content. Pictures, color coding, and borders were added to highlight key components in the RSP to aid in quickly identifying those components. There were minimal changes to the actual text content.

Three studies were conducted using non-medically trained JSC personnel (total of 34 participants). Non-medically trained personnel participated in order to approximate a scenario of limited CMO exposure to the RSP equipment and training (which can occur six months prior to the mission). In each study, participants were asked to perform two respiratory distress scenarios using one of the cue card designs to simulate resuscitation (using a mannequin along with the hardware).

Procedure completion time, errors, and subjective ratings were recorded. The last iteration of the cue card featured a schematic of the RSP, colors, borders, and simplification of the flow of information. The time to complete the RSP procedure was reduced by approximately three minutes with the new design. In an emergency situation, three minutes significantly increases the probability of saving a life. In addition, participants showed the highest preference for this design.

The results of the studies and the new design were presented to a focus group of astronauts, flight surgeons, medical trainers, and procedures personnel. The final cue card was presented to a medical control board and approved for flight. The revised RSP cue card is currently onboard ISS.

Cue card design guidelines developed as a result of this project include:

- Provide a definite "start" and "stop" point
- Create a linear flow of information
- Add numbers to steps
- Add schematic(s) or picture(s) to cue card, but avoid too many pictures/too much detail
- Use color where feasible for identification, but do not overuse color (e.g. for decoration)
- Highlight important words with the use of bold, underlined, or bordered text

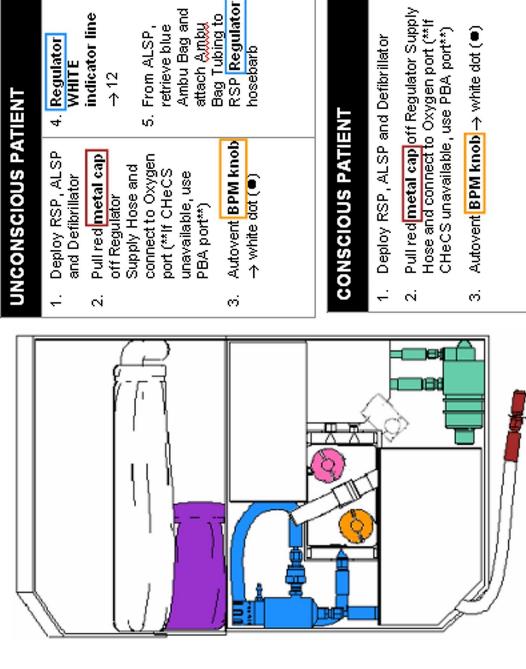
Picture Captions

Original Modified.jpg
Original RSP Cue Card Design

RecommendedCueCardwithColors.jpg
Redesigned RSP Cue Card (3 minute savings)

RESPIRATORY SUPPORT PACK CUE CARD #1 (Flight info)

Page 1 of 1 page



- attach Ambu Bag Tubing to RSP **Regulator**
- 8. Regulator Autovent Place Ambu breath every Patient and 5 sec while preparing LMA (in Bag on give 1
- insert ILMA using ILMA From IK/A cue card
- for Oxygen flow green indicator on top and feel 12. Patient Valve movement of from Patient <u>↓</u> Valve BPM knob → indicator line

11. Verify

- Tidal Volume Autovent
- Monitor patient Contact Flight Surgeon
- Regulator WHITE indicator line → 12
- Mask from RSP lid pocket and attach Mask Inlet Tubing to Regulator Remove Low Flow Non-Rebreather hosebarb

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Put mask on patient ø

- Surgeon Contact Flight
- 8. Monitor patient

RESPIRATORY SUPPORT PACK: RSP CUE CARD #1 ISS MED/5A.1 - ALL/FIN)

Page 1 of 1 page Airlock: ECLSS 02 Lo P Sply VIV RESPIRATORY SUPPORT PACK (RSP) SETUP ALGORITHM PCS

Verify Actual Position OPEN. AL 02 to P Supply My

Deploy RSP.

Decide whether to use Low Flow Mask, Ambu Bag, or htubate. (If intubating, attach patient valve to UMA)

Determine if additional treatment is required.

Set RSP, BPM = 12, TV = 800).

UNSCONSCIOUS

Tum Autovent BPM knob = dot

02 to Ambu Bag

Remove metal dustcap from Regulator supply hose and connectto CHeCS O2 supply hose. (**If CHeCS O2 supply unavailable, attach PBAs or shuttle O2 source).

Set Regulator flow rate = 12 L/min (CAUTION:

CONSCIOUS

32 to Low Flow Mask BPM knob = dot Set Regulator flow rate to 12 Limin (CAUTION: √Output by feeling for O2 1 ow from Regulator use WHITE Indicator line). hosebarb with hand use WHITE indicator line)

네output by feeling for 02 flow from Regulator Remove Low Flow Mask from RSP lid pocket

hosebarb

If Low Flow Mask will be used for > 15 minutes, and attach 02 tubing to Regulator hosebarb.

disconnect Autovent supply hose from Regulator

at Quick Disconnect (QD)

Remove Ambu Bag from ALSP and attach Ambu

Bag 02 supply hose to Regulator hosebarb.

Attach Patient Valve to UMS. Secure 02 line as needed for O2 flow and Mask (or remove mask and attach Ambu Bag Give one breath every 5 seconds with Ambu Bag

indicator on top of Patient Valve and by feeling

VFor 02 flow by observing movement in green

Set Autovent Tidal Volume = 800 ml

Set Autovent BPM = 12 initially

use WHITE Indicator line)

Set Regulator flow rate = 0 LAmin (CA UTION:

For use only in intubated patient

02 to ILM/

NTUBATED

disconnect Autovent supply hose from Regulator If Ambu Bag will be used for > 15 minutes, at Ouick Disconnect (OD)

If patient is to remain on Autowent > 15 min, insert HME Patient NOT Transported to Earth Will patient be transported back to Earth via shuttle?

Oz d

Complete patient treatment per ISS Medical C/L or Surgeon

between Patient Valve and ET Tube.

Use an Alcohol Pad to clean used equipment.

Restow RSP instructions.

Remove Patient Extension Hose from RSP lid pocket and remove one Heat atient Transported to Earth

Quickly disconnect Patient Valve from ET Tube, connect HME to ET Tube, Attach top (small end) of HME to L-shaped end of Extension Hose. and Moisture Exchanger (HME) from RSP.

and connect Extension Hose to Patient Valve.

Retrieve Portable Breathing Apparatus (PBA).

Obtain ISS Manned Systems Extension 02 line from Node or Arlock.

Connect Extension 02 line to space shuttle 02 source: Panel M069MM032M

Switch 02 supply from ISS CHe CS Rack to PBA.

Switch 02 supply from Portable 02 bottle to shuttle 02 source via extension Secure patient in shuttle for return to Earth. Move patient to shuttle.

Secure Autovent, Regulator, Patient Valve, and all flex lines near patient with Veloro straps in RSP lid.

ISS MED-1ab/ALL/A